TOTAL MAXIMUM DAILY LOAD (TMDL)

In

Fenholloway River

Bevins / Boggy Creek

Econfina River Basin

(Includes TMDLs for DO, BOD, Unionized Ammonia, Nutrients, Fecal Coliform, Total Coliform and Dioxin)

Taylor and LaFayette Counties, Florida

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LIST OF ABBREVIATIONS

BMP	Best Management Practices
BPJ	Best Professional Judgment
CFS	Cubic Feet per Second
DEM	Digital Elevation Model
DMR	Discharge Monitoring Report
EPA	Environmental Protection Agency
GIS	Geographic Information System
HUC	Hydrologic Unit Code
LA	Load Allocation
MGD	Million Gallons per Day
MOS	Margin of Safety
MS4	Municipal Separate Storm Sewer Systems
NASS	National Agriculture Statistics Service
NLCD	National Land Cover Data
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
OSTD	Onsite Sewer Treatment and Disposal Systems
PLRG	Pollutant Load Reduction Goal
Rf3	Reach File 3
RM	River Mile
SJRWMD	St. Johns River Water Management District
STORET	Storage Retrieval database
TMDL	Total Maximum Daily Load
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WBID	Water Body Identification
WCS	Watershed Characterization System
WLA	Waste Load Allocation
WMP	Water Management Plan

SUMMARY SHEET
Total Maximum Daily Load (TMDL)

1. **303(d) Listed Waterbody Information**
   State: Florida
   County: Alachua, Marion, and Lake
   Major River Basin: Econfina River Basin (HUC 03110102)

Impaired Waterbodies (1998 303(d) List):

WBID	Segment Name	Constituent(s)
3473A	Fenholloway at Mouth	DO
3473A	Fenholloway at Mouth	BOD
3473A	Fenholloway at Mouth	Nutrients
3473A	Fenholloway at Mouth	Dioxin - fish advisory
3473B	Fenholloway below Pulp Mill	DO
3473B	Fenholloway below Pulp Mill	Un-ionized NH3
3473B	Fenholloway below Pulp Mill	BOD
3473B	Fenholloway below Pulp Mill	Nutrients
3603	Bevins / Boggy Creek	Total Coliform
3603	Bevins / Boggy Creek	Fecal Coliform

2. **TMDL Endpoints (i.e., Targets)**
   DO: Florida DO standard of 5 mg/l or Natural Econfina River Values
   BOD: DO target
   Nutrients: Based on Natural Econfina River Values for Nutrients and Chla
   Dioxin: 0.014 ppq
   Un-ionized ammonia: 0.02 mg/l

3. **DO (mg/l) impacts due to BOD and Ammonia (mg/l) and Nutrients:**

TMDL under Existing DO Criterion

Stream Name	Parameter	WLA Existing DO criterion	LA	TMDL
			(mg/l - #/day) natural background concentrations and average loads	WLA plus average natural background loads
Fenholloway River 3473A & 3473B	D.O.	1,500,000 pounds/year		1,500,000 pounds/year
Fenholloway River3473A & 3473B	BOD5	2 mg/l – 717 #/day	2 mg/l – 333 #/day	1050 #/day
Fenholloway River 3473A & 3473B	Ammonia	0.07 mg/l – 25 #/day	0.07 mg/l – 12 #/day	37 #/day
Fenholloway River3473A & 3473B	TN	0.02 mg/l – 7.2 #/day	0.02 mg/l – 3.3 #/day	10.5 #/day
Fenholloway River 3473A & 3473B	TP	0.15 mg/l or 54 #/day	0.15 mg/l or 25 #/day	79 #/day

TMDL with Econfina River DO Referenced Conditions Criterion

Stream Name	Parameter	WLA Econfina Reference DO	LA	TMDL (may vary dependent on final alternative criterion selected)
		(#/day) expressed as rolling annual average for TN,TP	(mg/l - #/day) natural background concentrations and average loads	WLA plus average natural background loads
Fenholloway River	D.O.			
Fenholloway River	BOD5	1255	2 mg/l – 333 #/day	1588 #/day
Fenholloway River	Ammonia	360	0.07 mg/l – 12 #/day	372 #/day
Fenholloway River	TN	1075	0.02 mg/l – 6.7 #/day	1082 #/day
Fenholloway River	TP	360	0.15 mg/l or 25 #/day	385 #/day

4. Dioxin Allocation:

WBID	WLA	LA	TMDL
Fenholloway River 3473A	0.014 ppq	0	0.014 ppq

5. Coliform Allocation

WBID	Parameter	WLA	LA	TMDL
3603	Fecal Coliform	0	78 %	78 %
3603	Total Coliform	0	66 %	66 %

6. Public Notice Date: September 30, 2003

7. Endangered Species (yes or blank): yes

8. EPA Lead on TMDL (EPA or blank): EPA

9. TMDL Considers Point Source, Nonpoint Source, or both: Both

10. Major NPDES Discharges to surface waters

Facility Name	NPDES No.	Facility Type	Receiving Stream
Buckeye Florida Pulp Mill	FL0000976	Industrial Wastewater	Fenholloway River
City of Perry (Going no discharge – land application)	FL0026387	Domestic WWTP	Spring Branch

TOTAL MAXIMUM DAILY LOAD (TMDL)
ECONFINA RIVER BASIN (HUC 03010102)

1 INTRODUCTION

Section 303(d) of the Clean Water Act requires each state to list those waters within its boundaries for which technology based effluent limitations are not stringent enough to protect any water quality standard applicable to such waters. Listed waters are prioritized with respect to designated use classifications and the severity of pollution. In accordance with this prioritization, states are required to develop Total Maximum Daily Loads (TMDLs) for those water bodies that are not meeting water quality standards. The TMDL process establishes the allowable loadings of pollutants or other quantifiable parameters for a waterbody based on the relationship between pollution sources and in-stream water quality conditions, so that states can establish water quality based controls to reduce pollution from both point and non-point sources and restore and maintain the quality of their water resources (USEPA, 1991).

The State of Florida Department of Environmental Protection (FDEP) developed a statewide, watershed-based approach to water resource management. Under the watershed management approach, water resources are managed on the basis of natural boundaries, such as river basins, rather than political boundaries. The watershed management approach is the framework DEP uses for implementing TMDLs. The state's 52 basins are divided into 5 groups. Water quality is assessed in each group on a rotating five-year cycle. The Econfina Basin is a group 1 basin, first assessed in 2000 with plans to revisit water management issues in 2005. FDEP established five water management districts (WMD) responsible for managing ground and surface water supplies in the counties encompassing the districts. The Econfina Basin is in the Suwannee River Water Management District.

For the purpose of planning and management the Econfina Basin is divided into three planning units: Econfina River, Fenholloway River and Steinhatchee River Basins. A planning unit is either an individual primary tributary basin or a group of adjacent primary tributary basins with similar characteristics. These planning units contain smaller, hydrological based units called drainage basins, which are further divided into "water segments". A water segment usually contains only one unique waterbody type (stream, lake, cannel, etc.) and is about 5 square miles. Unique numbers or waterbody identification (WBIDs) numbers are assigned to each water segment.

2 Problem Definition

Florida's final 1998 Section 303(d) list identified numerous WBIDs in the Econfina River Basin as not supporting water quality standards (WQS). After assessing all readily available water quality data, EPA is responsible for developing TMDLs in 4 WBIDs (see Table 1). The pollutants of concern addressed in these TMDLs are: BOD, nutrients, dioxin, unionized ammonia, total coliform and fecal coliform The TMDLs addressed in this document are shown in Figure 1.

Table 1. TDMLs Developed By EPA in Econfina Basin

WBID	Segment Name	Constituent(s)
3473A	Fenholloway at Mouth	DO
3473A	Fenholloway at Mouth	BOD
3473A	Fenholloway at Mouth	Nutrients
3473A	Fenholloway at Mouth	Dioxin - fish advisory

3473B	Fenholloway below Pulp Mill	DO
3473B	Fenholloway below Pulp Mill	Un-ionized NH3
3473B	Fenholloway below Pulp Mill	BOD
3473B	Fenholloway below Pulp Mill	Nutrients
3603	Bevins / Boggy Creek	Total Coliform
3603	Bevins / Boggy Creek	Fecal Coliform

The TMDLs addressed in this document are being established pursuant to EPA commitments in the 1998 Consent Decree in the Florida TMDL lawsuit (Florida Wildlife Federation, et al. v. Carol Browner, et al., Civil Action No. 4: 98CV356-WS, 1998).

Waters in the Econfina River Basin are designated as Class III waters having a designated use of recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife. The level of impairment is denoted as threatened, partially or not supporting designated uses. A stream that is classified as threatened currently meets WQS but trends indicate the designated use may not be met in the next listing cycle. A stream classified as partially supporting designated uses is defined as somewhat impacted by pollution and water quality criteria are exceeded on some frequency. For this category, water quality is considered moderately impacted. A stream that is categorized as not supporting is highly impacted by pollution and water quality criteria are exceeded on a regular or frequent basis. On these streams, water quality is considered severely impacted.

The format of the remainder of this report is as follows: Chapter 3 is a general description of the Econfina River Basin and Fenholloway River and Bevins / Boggy Creek watersheds; Chapter 4 describes the water quality standard and target criteria for the TMDLs; Chapter 5 describes the development of the DO, BOD, Ammonia and Nutrient TMDLs for Fenholloway River, Chapter 6 describes the development of the Dioxin TMDLs, and chapter 7 the total and fecal TMDLs for Bevins / Boggy. Chapters 3 and 4 are general and apply to all the TMDL parameters. Within each chapter on the specific TMDLs is a section detailing the data assessment, Source Assessments, TMDL development and margin of safety.

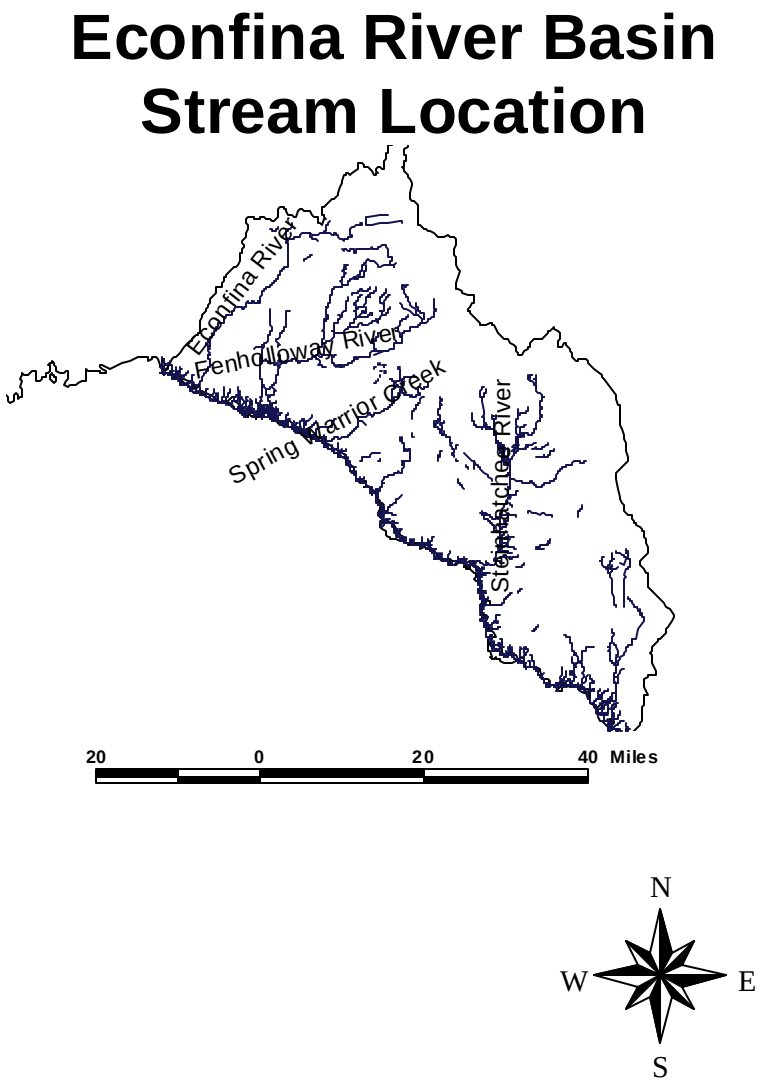

Figure 1. Location of Streams in Econfina Basin

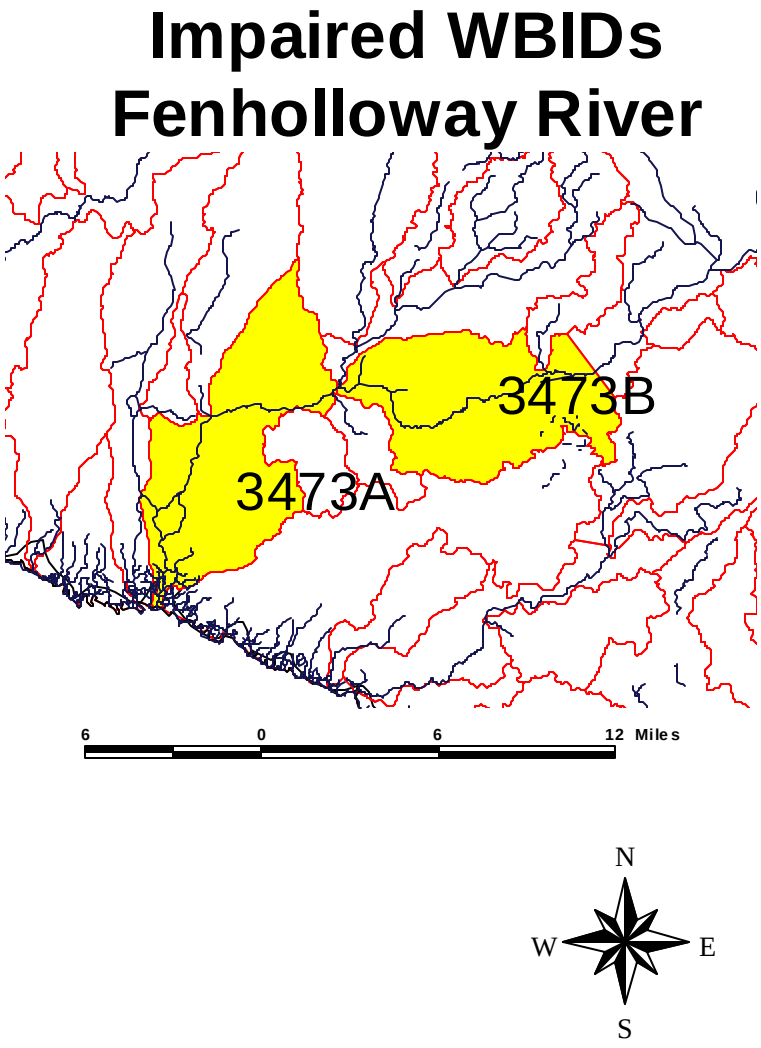

Figure 2. Location of Listed WBIDs in Fenholloway Watershed

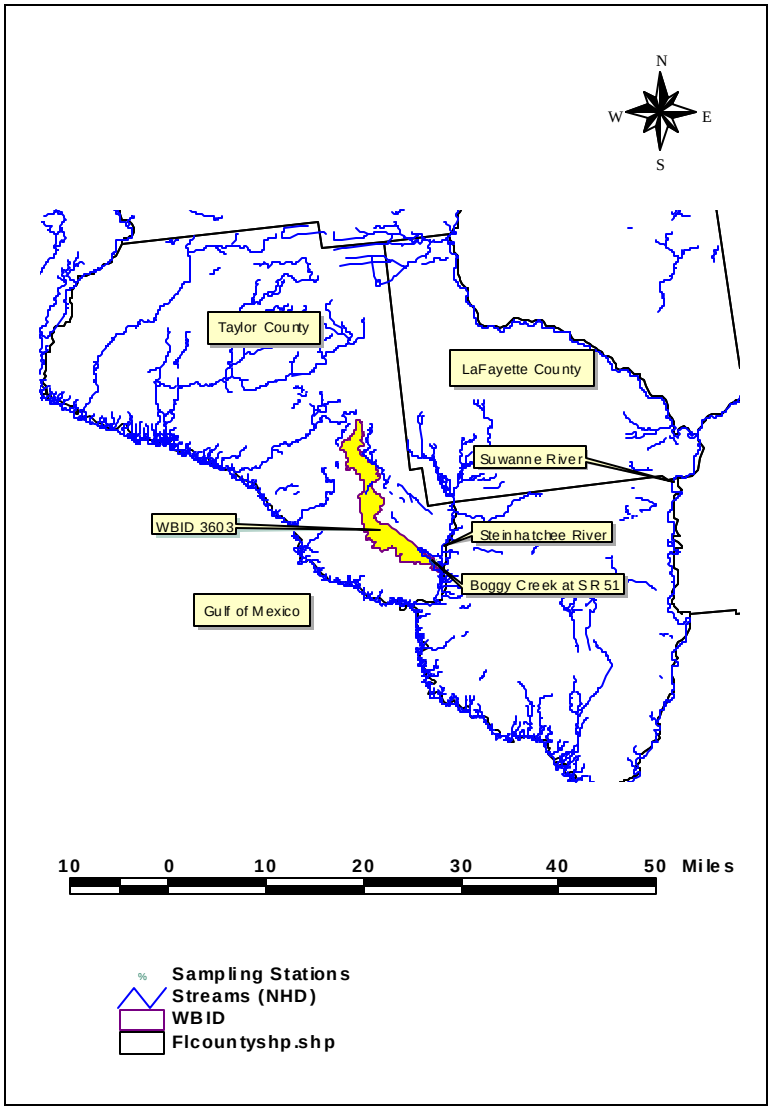

Figure 3 Location of the Bevins / Boggy Creek Watershed

3 WATERSHED DESCRIPTION

The Econfina River spans the length of Taylor County, draining ultimately into the Gulf of Mexico. Lying within the Gulf Coast Flatwoods Subecoregion (75a), the land is a combination of pine flatwoods and swamp forests. Land use within the basin consists of cropland, pastures, and mixed forest lands. Since 1992, minimally disturbed reference streams have been sampled throughout Florida for the purpose of establishing biological community expectations and identifying specific thresholds for assessing stream health. The Stream Condition Index (SCI) has been the primary assessment method, which consists of collecting 20 D-frame dipnet sweeps (0.5 m in length) of the most productive habitats in a 100 m reach of stream. The organisms are sub-sampled, sorted, and identified to the lowest practical taxonomic level. Seven measurements of invertebrate health are calculated and compared with the expectations established by the reference site sampling. These reference streams are sampled periodically to maintain accurate expectations to which other streams in the same region are compared. The Econfina River is a reference stream in the Florida panhandle.

The Econfina River has measured minimum, average and maximum D.O. values of 0.9 mg/l, 5.4 mg/l and 8.7 mg/l respectively. These D.O. values are representative of normal healthy blackwater systems. Nutrient concentrations were not problematic in the Econfina River, tending to be lower than average for Florida streams on most sampling dates. SCI scores for the Econfina River were in the "excellent" range for three of the four sampling trips. The SCI score was in the "good" range in February 1995. Overall, the results indicate that the Econfina River is a healthy system.

The Fenholloway River and Estuary are located in northern Florida. The Fenholloway River is 36 miles long; its watershed drains approximately 392 square miles. The upper areas of the watershed are underlain by the Floridian aquifer system. It is confined in the upper headwaters and becomes semi-confined and unconfined moving southwest across San Pedro Bay. Exposed limestone can be seen in the reaches of the Fenholloway River just upstream of the pulp mill. Continuing toward the Gulf of Mexico, the watershed is underlain by a shallow surficial aquifer that is approximately 5 to 20 feet below ground surface. Sandy soils dominate the watershed area, though karstic features are also present. The pulp mill has impacted the hydrology and water quality of the Fenholloway River since 1954. In 1947, the Florida state legislature designated the Fenholloway River as Class V for navigation, utility, and industrial use. In 1997, the designation of the Fenholloway River was changed to Class III for recreational use, propagation and maintenance of a healthy, well-balanced population of fish and wildlife based on the findings of the Use Attainability Analysis completed in December 1994 by the Florida Department of Environmental Protection.

Over the past decade, there has been significant concern over the water quality in the river and estuary, with a focus on color, dissolved oxygen, and nutrient impairments due to loading from the pulp mill, the major point source discharge to the system. The pulp mill is permitted under NPDES permit number FL0000876 with effluent limits for Biochemical Oxygen Demand (BOD) and dissolved oxygen

Land cover for the WBIDs covered in this report is based on the National Land Cover Dataset (NLCD) of 1995, and tabulated in Table 2. Forested land, including planted pine plantations, and wetlands account for the majority of the land use in the impaired WBIDs.

	Econfina Watershed		Fenholloway Watershed		Steinhatchee Watershed	
Residential	160	0%	5220	3%	45	0%
Commercial, industry, public	95	0%	902	1%	258	0%
Agriculture	4004	2%	5675	3%	501	0%
Rangeland	3585	2%	10036	6%	799	0%
Forest	57782	35%	65847	39%	67714	32%
Water	680	0%	351	0%	94	0%
Wetlands	81277	49%	64158	38%	104186	50%
Barren & extractive	16919	10%	17498	10%	35482	17%
Transportation and utilities	0	0%	632	0%	0	0%
Total Area	164503	100%	170320	100%	209078	100%

Table 2. Land Cover Distribution[1] (acres)

Bevins (Boggy) Creek is located in Taylor County in the Steinhatchee Planning Unit. The Steinhatchee is part of the Suwannee River Basin. Bevins Creek is a tributary to the Steinhatchee River, which discharges into the Gulf of Mexico (see Figure 1). Land cover in the watershed is shown in Table 1 and is based on the National Land Cover Dataset (NLCD) obtained from 1990 Landsat Thematic Mapper Data (Vogelmann, 2001). Wetlands and forested areas are the dominant features of the Bevins Creek watershed. Although the NLCD data is from 1990 images, land cover in the Taylor County area has not changed significantly. According to the Florida Department of Environmental Protection (DEP) Basin Status Report for the Suwannee Basin, the Steinhatchee River watershed is 98 percent pine flatwoods and wetlands, most of which is used for commercial timber production (DEP, 2001).

Table 3. Land Use in the Bevins (Boggy) Creek Watershed (acres, Vogelmann, 2001)

Urban		Agriculture		Forest		Wetlands		Water		Barren, transitional		Total
Area	%	Area	%	Area	%	Area	%	Area	%	Area	%	Area
45	0.28	218	.96	5954	26	11,862	52	14.7	0.06	4575	20	22,668

Note: Urban area includes land cover classified as commercial, industrial, and transportation; agriculture area includes land cover classified as rangeland..

4 WATER QUALITY STANDARD AND TARGET IDENTIFICATION

Waterbodies in the Econfina River Basin are classified as Class III waters, with a designated use classification for recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife. The water quality criteria for protection of Class III waters, are established by the State of Florida in the Florida Administrative Code (F.A.C.), Section 62-302.530. The individual criteria should be considered in conjunction with other provisions in water quality standards, including Section 62-302.500 F.A.C. [Surface Waters: Minimum Criteria, General Criteria] that apply to all waters unless alternative or more stringent criteria are specified in F.A.C. Section 62-302.530. In addition, unless otherwise stated, all criteria express the maximum not to be exceeded at any time. The specific criteria are as follows:

4.1 Dissolved Oxygen

The Fenholloway River is a Class III waterbody with designated uses of recreation, propagation and maintenance of a healthy, well balanced population of fish and wildlife. The Class III freshwater criterion for DO, as established by Rule 62-302.530(31), Florida Administrative Code, states that the dissolved oxygen shall not be less than 5 mg/L and that normal daily and seasonal fluctuations above these levels shall be maintained.

While the river was verified as not supporting the Class III DO criterion, there is evidence indicating DO levels for the rivers in Econfina River Basin are less than the freshwater criterion due to natural conditions. The lower DO levels in the Econfina River Basin can be partly attributed to drainage from wetland areas that border the river channel. The Econfina River has measured minimum, average and maximum D.O. values of 0.9 mg/l, 5.4 mg/l and 8.7 mg/l respectively. These D.O. values are representative of normal healthy blackwater systems. Nutrient concentrations were not problematic in the Econfina River, tending to be lower than average for Florida streams on most sampling dates. SCI scores for the Econfina River were in the “excellent” range for three of the four sampling trips. The SCI score was in the “good” range in February 1995. Overall, the results indicate that the Econfina River is a healthy system. Based on this information, the development of an alternative DO criterion appears to be warranted for streams, including the Fenholloway River, in the Econfina River Basin.

4.2 Nutrients

Fenholloway River is classified as a Class III Freshwater body, with a designated use of recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife. The Class III water quality criteria applicable to the observed impairment is the narrative nutrient criterion (nutrient concentrations of a body of water shall not be altered so as to cause an imbalance in natural populations of aquatic flora or fauna). Because the nutrient criterion is narrative only, a nutrient related target was

needed to represent levels at which imbalance in flora or fauna are expected to occur. For this TMDL, the Econfina River esturary is used as a reference site. The nutrient target concentrations are based upon an allowable 25% increase in the mean concentrations of total nitrogen and phosphorous observed in the Econfina River estuary.

4.3 Unionized Ammonia

The unionized ammonia criterion is that in no case shall concentrations exceed 0.02 milligram/L. Unionized ammonia is based on ammonia, temperature and pH. For the Fenholloway River the ammonia levels necessary to meet the DO criteria will assure the unionized ammonia criteria is met. (add pH and temp used to verify this)

4.4 Dioxin

The Dioxin criterion is less than or equal to 0.014 ppq. This criterion was promulgated by EPA in 1992 for the State of Florida under the 1992 National Toxics Rule.

4.5 Fecal Coliform Bacteria

The most probable number (MPN) or membrane filter (MF) counts per 100 ml of fecal coliform bacteria shall not exceed a monthly average of 200, nor exceed 400 in 10 percent of the samples, nor exceed 800 on any one day. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period.

When sufficient data (i.e., more than 10 samples collected at one location in last five years) are available to identify wet weather as the probably cause of impairment, the target for the fecal coliform TMDLs is the one-day maximum criteria of 800 counts/100mL. It is appropriate to use the acute criteria for TMDL development because the data indicates violations of the standard are typically related to storm events, which are short-term in nature. Violations of the chronic criteria are typically associated with point sources or non-point source continuous discharges (e.g., leaking septic systems) and typically occur during all weather conditions. Targeting the acute criteria should be protective of the 400 in 10 percent of the samples and geometric mean criteria.

When insufficient data are available, the confidence the data provides to identify the conditions leading to impairment (i.e., wet weather vs. continuous discharge, or low flow) is not as strong. To ensure the TMDLs protective during both low flow and wet weather conditions, the target of the TMDLs is the not to exceed 400 in 10 percent of the samples. This criterion is more restrictive than the one-day maximum criterion, and by meeting the 400 criterion, there is greater confidence the TMDL will be protective during wet weather conditions than if the one-day maximum criterion is the target.

4.6 Total Coliform Bacteria

The MPN per 100 ml of total coliform bacteria shall be less than or equal to 1,000 as a monthly average nor exceed 1,000 in more than 20 percent of the samples examined during any month, and less than or equal to 2,400 at any time. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period.

The target for the total coliform TMDLs is the one-day maximum concentration of 2400 counts/100mL, as less than 10 samples were collected in a 30-day period to determine violations of the not to exceed percentage criterion or the geometric mean. Total coliform bacteria generally indicate the presence of soil-associated bacteria and result from natural influences on a water body such as rainfall runoff as well as sewage inflows (i.e., acute conditions). By protecting the acute criteria (i.e., one-day maximum) bacteria concentrations in the stream should meet the chronic criteria.

5 DO, BOD, Ammonia and Nutrient TMDLS

This section of the report details the development of DO, BOD, Ammonia and Nutrient TMDLs in 2 Fenholloway WBIDs in the Econfina River Basin. Section 2 identifies these waterbodies and the parameter of concern.

5.1 Water Quality Assessment and Deviation from Target

FDEP maintains ambient monitoring stations throughout the basin. In addition, Buckeye Florida Pulp Mill collects DO and other chemical data on a daily basis in the Fenholloway River and contracted special studies in the Econfina River Basin area. EPA has also conducted special studies in both the river and estuary area of the Econfina and Fenholloway Rivers. These data and information are available in the following reports:

5.2 Source Assessment

An important part of the TMDL analysis is the identification of source categories, source subcategories, or individual sources in the watershed and the amount of pollutant loading contributed by each of these sources. Sources are broadly classified as either point or non-point sources.

A point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Point source discharges of industrial wastewater and treated sanitary wastewater must be authorized by National Pollutant Discharge Elimination System (NPDES) permits.

The nonpoint source is defined as a diffuse source that cannot be identified as entering a waterbody through a discrete conveyance at a single location. These sources generally, but not always, involve accumulation of pollutant on land surfaces and wash off as a result of storm events. For the Econfina River Basin and the Fenholloway River watershed the vast majority of the nonpoint source runoff is natural background levels of pollutants – BOD, Ammonia, Nutrients - running off of wetlands, forest and other non human impacted areas. The nonpoint source runoff in the basin does not adversely impact natural water quality conditions.

5.2.1 Point Sources

There are two major point sources, discharging the pollutants of concern, located in the drainage areas of the Fenholloway River 303(d) listed stream segments that possess NPDES permits for discharges of treated sanitary and industrial wastewater. These facilities are Buckeye Florida Pulp Mill (FL0000876) and City of Perry Wastewater Treatment Facility (WTF) (FL0026387).

The City of Perry WTF will be cease discharging and going to a land treatment system with no discharge in 2004, therefore this facility is not included in the WLA portion of the TMDL.

Buckeye Florida Pulp Mill discharges into the Fenholloway River upstream of Hwy 98, 20 miles from the mouth of the river and has the following wastewater characteristics:

- Flow = 43 mgd
- BOD5 = 22 mg/l
- Ammonia = 3.3 mg/l
- Total Nitrogen (TN) = 5 mg/l
- Total Phosphorus (TP) = 2 mg/l

5.2.2 Nonpoint Sources

For the Fenholloway River watershed the vast majority of the nonpoint source runoff is natural background

levels of pollutants – BOD, Ammonia, Nutrients - running off of wetlands, forest and other non human impacted areas. The nonpoint source runoff in the basin does not adversely impact natural water quality conditions.

5.3 Analytical Approach

Because of the complexity of the fate and transport of material discharging from the mouth of the Fenholloway River to the Gulf of Mexico, the intrusion of salinity up the Fenholloway River, and the transport along the main channel of the Fenholloway River, complex and comprehensive hydrodynamic and water quality modeling frameworks were applied to investigate to what extent color, BOD, and nutrient loads would have to be reduced in order to protect the designated uses of the Fenholloway River and the offshore waters. The framework consists of a three-dimensional model of the lower portions of the river and the immediate nearshore waters of the Gulf of Mexico, as well as a one-dimensional, model of the upper segments of the river above the point of salinity intrusion. The details of these models are included in the Fenholloway River and Estuary: Hydrodynamic and Water Quality Modeling Report, May 2003 (Tetratech 2003); EPA's draft Fenholloway River and Estuary Modeling Application Reports (EPA 2003)

Two models were set up to represent the Fenholloway River, its estuary, and offshore areas. A one-dimensional, hydrodynamic and water quality model was developed and calibrated for the upper portions of the river. This extended from just downstream of the riverine location of the Fish Camp (RM 2.6) and extended upstream to CR-356C (RM 26.5), which is just upstream of the pulp mill discharge location. The second model was a three-dimensional hydrodynamic and water quality model including the riverine portion described above, as well as the nearshore area with coverage 2 miles offshore, 4.5 miles north and 4.5 miles south of the mouth. The calibration period for both models was from 1998 to 2001, with the river being confirmed based on the early 1990's data and information.

Both the one-dimensional and three-dimensional hydrodynamics of the Fenholloway River and Estuary were modeled using the Environmental Fluid Dynamics Code (EFDC). EFDC was applied with water surface elevation forcing at the downstream boundary and freshwater inflows at the upstream boundaries. Water surface elevation, flows, currents, salinity, temperature, and color were simulated using EFDC. Color was simulated within the EFDC model application as a conservative substance.

The U.S. EPA Water Quality Analysis Simulation Program, version 6.1 was applied as the water quality model (Ambrose et al., 1993. Wool et. al., 2001). The eutrophication component of WASP was used to simulate the complex nutrient transport and cycling in the river and estuary, as well as determining the dissolved oxygen sag within the riverine portion. The purpose of the modeling exercise was to determine what reduction in color and nitrogen loads to the estuary would have to occur to protect the water body's designated use, as well as the reduction in BOD loading to meet dissolved oxygen water quality standards within the riverine portions and estuary.

The simulation period for the purposes of this study was 1998 to 2001. The data utilized in the development of hydrodynamic boundary conditions and for the purpose of model calibration consisted of the following types:

- Measured freshwater flows within the Fenholloway River and Spring Creek,
- Measured flows from point source discharges,
- Measured and projected tides within the Gulf of Mexico,
- Measured meteorological data, and
- Measured salinity, temperature and color at various stations throughout the system.

The calibration of dissolved oxygen in the riverine model was undertaken at three locations: SR-356 (RM 13.9), Cooey Bridge (RM 7.3), and Fish Camp (RM 2.6). At SR-356 there is approximately daily dissolved oxygen data observed by Buckeye Florida. At SR-356, Cooey Bridge, and Fish Camp the measured data is approximately monthly to quarterly, observed mostly by EP&A, but also by EPA.

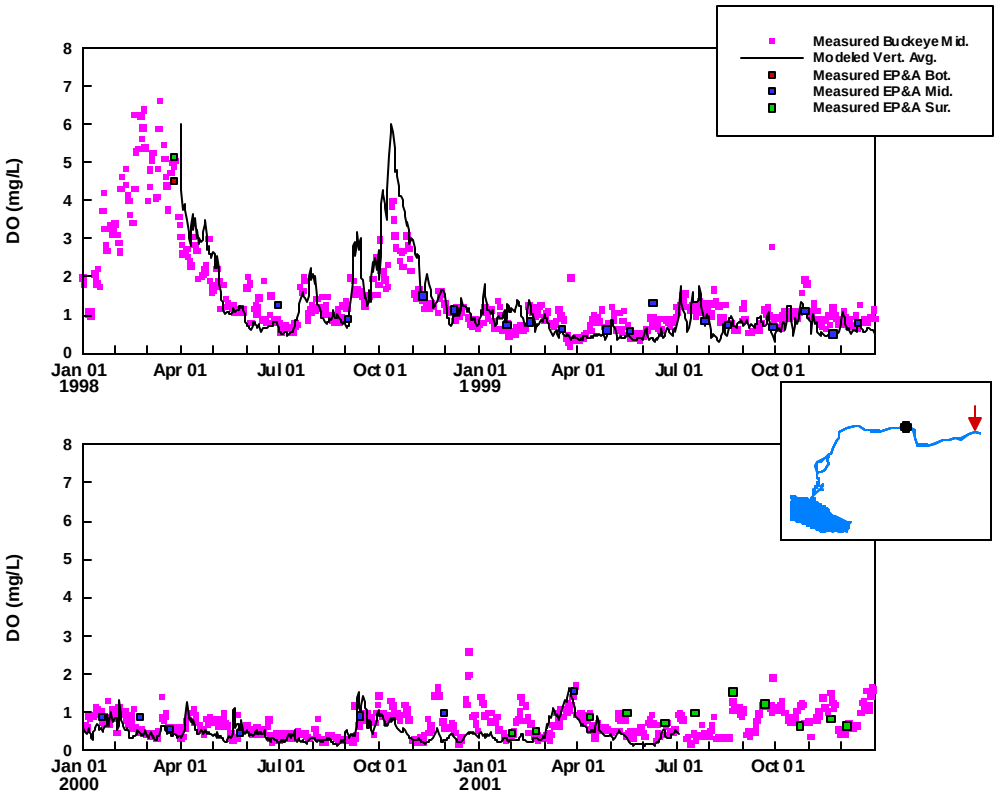

Figure 4 DO Calibration for Fenholloway River

Four treatment options were evaluated as options to meet the Fenholloway River Class III Standard and the reference DO Target. These treatment alternatives are:

- Washing & Screening (W&S)
  - BOD = 20 mg/l; Ammonia = 2 mg/l
- Process Technology (PT)
  - BOD = 9 mg/l; Ammonia = 1.2 mg/l
- Wastewater (WWT)
  - BOD = 5 mg/l; Ammonia = 0.5 mg/l
- Wetlands (WL)
  - BOD = 3.5 mg/l; Ammonia = 0.2 mg/l

Table 3 provides the predicted DO percentile ranges for the treatment alternatives as well as the DO profile for Econfina River based on existing available data.

Table 4 Fenholloway Rivers DO for Various Treatment Scenarios

Percentile	W&S	PTech	WTF	Wetlands	Econfina
10	0.0	0.5	2.0	3.4	4.5
25	0.7	2.7	4.0	5.0	4.9
50	1.5	3.6	4.8	5.8	5.7
75	2.1	4.5	5.5	6.5	6.5
90	3.1	5.3	6.1	7.3	7.7

As previously stated the Fenholloway River without the discharge would be a naturally low DO wetlands dominated system that should have similar characteristics as the Econfina River. To replicate these natural DO ranges, the proposed draft WLA to meet the DO target are BOD and Ammonia of:

- BOD5 = 3.5 mg/l to be applied as a monthly average (same as wetland option)
- Ammonia = 1 mg/l (up from the 0.2 mg/l given for wetlands option) The ammonia level also meets the unionized ammonia criteria of 0.02 mg/l.

To meet the Class III DO standard of 5 mg/l, the same treatment alternatives are needed along with 1.5 million pounds per year of oxygen added to the Fenholloway River at every one-mile increments whenever the segments of the river go below the 5 mg/l DO. This alternative was evaluated in the mid 1990s and determined to be physically unfeasible, in that it would require extensive modification to the Fenholloway River channel. The other alternative is a no discharge option, but this also would not provide for the DO standard of 5 mg/l to be met, but the Fenholloway River without a point source discharge would again mimic the natural DO range of the Econfina River. Since the existing water quality criterion for dissolved oxygen is 5.0 mg/l, the TMDL wasteload allocation will require removal of the Buckeye Florida discharge. However, in order to expedite the development of a site-specific dissolved oxygen criterion based upon the dissolved oxygen profile observed in the Econfina River, EPA also offers for public comment a wasteload allocation designed to achieve a comparable dissolved oxygen profile in the Fenholloway River.

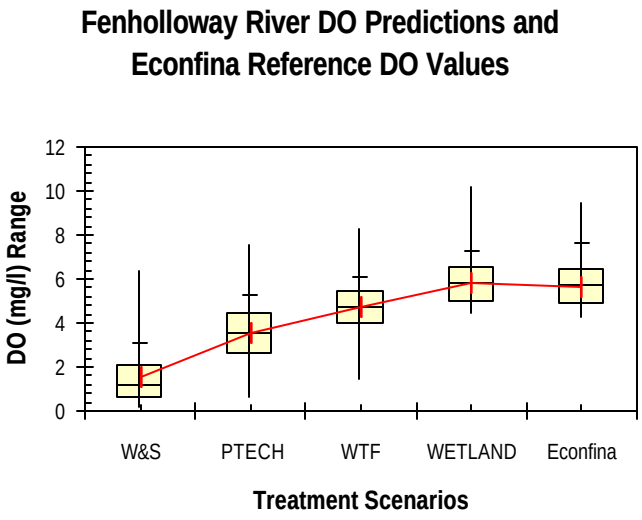

Figure 5 Fenholloway DO Predictions

The calibration of nutrients and chlorophyll-a in the estuarine and offshore model was undertaken by focusing on the exit of the estuary and the near shore areas. As the nutrients from the river are discharged and mixed with the waters from the Gulf of Mexico there is more opportunity for a algal growth. This opportunity can be attributed to a few factors. The velocity of the water slows as it enters the offshore. The dilution to the color loading is greatly increased, thus allowing more light penetration, which can promote primary production. A point of interest in this study was to what level the chlorophyll-a will change based upon the current nutrient levels combined with a reduction in color loading from the pulp mill.

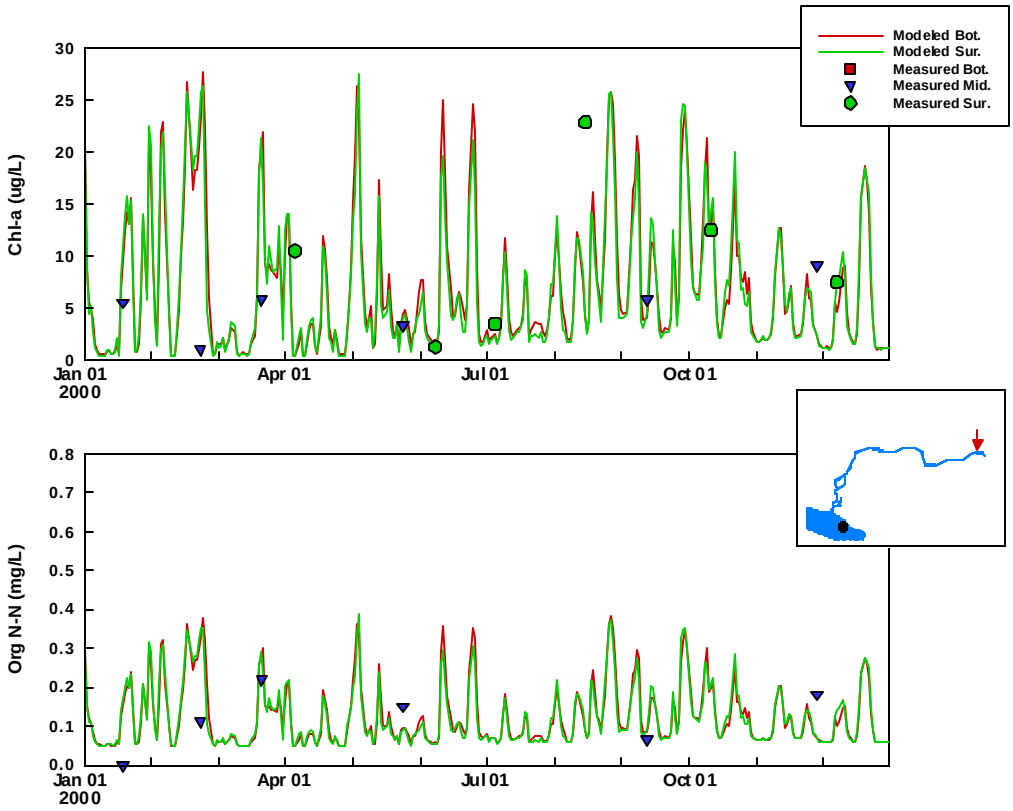

Figure 6 Chla and Organic N Calibration in Near Shore Area (Station F14)

In general, the models are able to simulate the conditions within the riverine, estuarine, and nearshore areas and appear to be parameterized to capture the critical processes. The hydrodynamic model simulates the degree of salinity intrusion and matches the location of the density front along the river. The levels of dilution and transport, through matching of the color measurements, indicate that the freshwater inflow and transport are accurate. The water quality model simulates the dissolved oxygen conditions well. Nutrient comparisons between the model and the measured data appear reasonable. The chlorophyll-a simulations show that the model is responding to the overall conditions and the low growth potential identified in the EPA study. The level of growth increases near the mouth of the Fenholloway, and the model demonstrates this.

In July 1998, the pulp mill reduced effluent color concentrations by approximately 50 percent, from approximately 2200 PCU to 1100 PCU.

In order to allow consistent comparisons between the alternatives, the model was run for a single year period under each scenario. The critical period for scenario evaluations was chosen as year 2000. Year 2000 was a below average precipitation year and represents worst case low flow conditions. It was expected that during periods of drought, the pulp mill discharge is a larger portion of the flow in the river and results in less dilution to the color, BOD, and nutrient loading.

Utilizing the calibrated model presented various treatment scenarios were evaluated to determine their relative ability to meet the Class III water quality standards. These scenarios encompassed a variety of alternatives ranging from plant improvements to wetland treatment of the effluent discharge. The following scenarios were evaluated:

- W&S Improvements TN = 4 mg/l; TP = 1.9 mg/l

- Process Technology TN = 3.1 mg/l; TP = 0.7 mg/l
- WWT Improvements TN = 3 mg/l; TP = 1.0 mg/l
- Wetlands Treatment TN = 3 mg/l; TP = 0.2 mg/l

As previously stated, Fenholloway River is classified as a Class III Freshwater body, with a designated use of recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife. The Class III water quality criteria applicable to the observed impairment is the narrative nutrient criterion (nutrient concentrations of a body of water shall not be altered so as to cause an imbalance in natural populations of aquatic flora or fauna). Because the nutrient criterion is narrative only, a nutrient related target was needed to represent levels at which imbalance in flora or fauna are expected to occur. For this TMDL, a screening level nutrient target of no more 25% increase over natural expected nutrient values based on the Econfina reference site.

The modeling approach uses the model "No Load" scenario as the baseline and compares the nutrient changes from the treatment alternatives to "No Load" scenario. This provides information on how much the various treatment alternatives will increase the background nutrient values and how much of an increase can be expected from the Econfina Estuary reference values. The "No Load" Scenario is on the conservative side because it is slightly over predicting Chla and is under predicting TN when compared to the Econfina Near Coastal Area.

Table 5 Econfina Chla and Nutrient Reference Values

Percentiles	25	50	75
Econfina Near Shore Area Chla (ug/l)	1	2	4.4
"No Load" Scenario Chla (ug/l)	2.3	3.9	5.2
Econfina Near Shore Area TN (mg/l)	0.14	0.34	0.54
"No Load" Scenario TN (mg/l)	0.14	0.15	0.15
Econfina Near Shore Area TP (mg/l)	0.014	0.022	0.04
"No Load" Scenario TP (mg/l)	0.018	0.020	0.021

Tables 5 to 7 show the predicted CHLa, TP and TN values for the four treatment scenarios with the percent increase over the 50 percentile (median) value. Based on the nutrient target stated previously, a nutrient WLA of TN = 3 mg/l and TP = 1 mg/l will meet the nutrient target on an annual average basis.

Table 6 Chla Results for the Treatment Alternatives

Percentile	25	50	% difference from mean	75	90
	Chla				
W&S	2.352	4.508	130%	8.940	15.334
PT	2.335	4.327	125%	8.162	12.906
WWF	2.191	3.973	115%	7.270	11.539
No Load	2.090	3.462	100%	5.333	6.847

Table 7 Total Phosphorus for the Treatment Alternatives

Percentile	25	50	% difference from mean	75	90
	TP				
W&S	0.020	0.026	134%	0.051	0.085
PT	0.020	0.023	115%	0.033	0.047
WWF	0.020	0.022	113%	0.030	0.041
No Load	0.018	0.020	100%	0.021	0.023

Table 8 Total Nitrogen for the Treatment Alternatives

Percentile	25	50	% difference from mean	75	90
	TN				
W&S	0.145	0.175	120%	0.281	0.411
PT	0.145	0.164	113%	0.243	0.336
WWF	0.145	0.170	117%	0.260	0.369
No Load	0.144	0.146	100%	0.148	0.151

The wetlands treatment option can achieve a total phosphorus concentration of 0.2 mg/l and would result in a greater phosphorus reduction than is required by the TMDL.

5.4 Development of Total Maximum Daily Loads

The TMDL process quantifies the amount of a pollutant that can be assimilated in a waterbody, identifies the sources of the pollutant, and recommends regulatory or other actions to be taken to achieve compliance with applicable water quality standards based on the relationship between pollution sources and in-stream water quality conditions. A TMDL can be expressed as the sum of all point source loads (Waste Load Allocations), non-point source loads (Load Allocations), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$TMDL = \Sigma WLAs + \Sigma LAs + MOS$

The objective of a TMDL is to allocate loads among all of the known pollutant sources throughout a watershed so that appropriate control measures can be implemented and water quality standards achieved. 40 CFR §130.2 (i) states that TMDLs can be expressed in terms of mass per time (e.g. pounds per day), toxicity, or other appropriate measure.

5.4.1 Determination of TMDL, WLAs, & LAs

The TMDL values represent the maximum daily load the stream can assimilate and maintain water quality standards. Because the Fenholloway River is an effluent dominated system and the load allocation portion of the TMDL is all natural background values, the TMDL will be expressed as WLA (#/day) plus natural background concentrations and the natural background load based on an annual average background flow of 20 million gallons per day (mpg).

For the BOD and DO TMDL the TMDL is written to meet the basically unachievable existing DO standard of 5 mg/l. To meet this DO standard oxygen must be added to the Fenholloway segments (every one mile) when the DO in these individual segments drops below 5 mg/l. It is estimated that an average load of 1,500,000 pounds per year will be required. The annual natural background load allocation is based on a discharge flow of 43 mgd and an annual river flow of 20 mgd, the measured gaged flow minus the Buckeye Florida discharge flow.

Table 9. TMDL under Existing DO Criterion

Stream Name	Parameter	WLA Existing DO criterion	LA	TMDL
			(mg/l - #/day) natural background concentrations and average loads	WLA plus average natural background loads
Fenholloway River 3473A & 3473B	D.O.	1,500,000 pounds/year		1,500,000 pounds/year
Fenholloway River3473A & 3473B	BOD5	2 mg/l – 717 #/day	2 mg/l – 333 #/day	1050 #/day
Fenholloway River 3473A & 3473B	Ammonia	0.07 mg/l – 25 #/day	0.07 mg/l – 12 #/day	37 #/day
Fenholloway River3473A & 3473B	TN	0.02 mg/l – 7.2 #/day	0.02 mg/l – 3.3 #/day	10.5 #/day
Fenholloway River 3473A & 3473B	TP	0.15 mg/l or 54 #/day	0.15 mg/l or 25 #/day	79 #/day

FDEP Water Quality Standards allow the State to revise the DO criterion based on natural conditions using a reference stream approach. That has not yet been done in this case. However, EPA has conducted a technical evaluation at a reference stream for this TMDL. The Econfina River reference stream, located near the Fenholloway River, has measured minimum, average and maximum D.O. values of 0.9 mg/l, 5.4 mg/l and 8.7 mg/l respectively. These D.O. values are representative of normal healthy blackwater systems. Nutrient concentrations were not problematic in the Econfina River, tending to be lower than average for Florida streams on most sampling dates. SCI scores for the Econfina River were in the “excellent” range for three of the four sampling trips. The SCI score was in the “good” range in February 1995. Overall, the results indicate that the Econfina River is a healthy system. Based on this information, the development of an alternative DO criterion appears to be warranted for streams, including the Fenholloway River, in the Econfina River Basin. Therefore a TMDL was also calculated to meet these possible alternatives DO criterion.

Table 10 TMDL with Econfina River DO Referenced Conditions

Stream Name	Parameter	WLA Econfina Reference DO	LA	TMDL (may vary dependent on final alternative criterion selected)
		(#/day) expressed as rolling annual average for TN,TP	(mg/l - #/day) natural background concentrations and average loads	WLA plus average natural background loads
Fenholloway River	D.O.			
Fenholloway River	BOD5	1255	2 mg/l – 333 #/day	1588 #/day
Fenholloway River	Ammonia	360	0.07 mg/l – 12 #/day	372 #/day
Fenholloway River	TN	1075	0.02 mg/l – 6.7 #/day	1082 #/day
Fenholloway River	TP	360	0.15 mg/l or 25 #/day	385 #/day

Note: 1) DO is covered by the BOD and Ammonia reductions and unionized ammonia by the Ammonia reductions, assuming a stream pH of 7 and temperature of 30 degree C. 2) TN and TP address the nutrient issues. 3) #/day = pounds/day.

The TMDL proposed here in is located in Table 9. EPA is providing the alternative in Table 10 as information because it is EPA's understanding that FDEP will pursue this alternative and propose a site specific DO criteria update to their Water Quality Standards..

5.4.2 Waste Load Allocations

Table 11 Buckeye Florida Pulp Mill and Perry WWTP WLA

Stream Name	Parameter	Buckeye Florida Pulp Mill	Perry WWTP	WLA
		FL000856	Going no discharge – land application	(#/day) expressed as rolling annual average
Fenholloway River	BOD5	1255		1255
Fenholloway River	Ammonia	360		360
Fenholloway River	TN	1075		1075
Fenholloway River	TP	360		360

5.4.3 Load Allocations

For the Fenholloway River watershed the vast majority of the nonpoint source runoff is natural background levels of pollutants – BOD, Ammonia, Nutrients - running off of wetlands, forest and other non human impacted areas. The nonpoint source runoff in the basin does not adversely impact natural water quality conditions. The natural background levels are listed in Table 3.

5.4 Margin of Safety

There are two methods for incorporating a MOS in the analysis: a) implicitly incorporate the MOS using conservative model assumptions to develop allocations; or b) explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations. In the Econfina-Fenholloway Basin TMDLs an implicit MOS was used. For TMDLs developed using the Fenholloway River Model 3 years (1998 – 2000, which

incorporated two critical low flow years) of simulation were used to develop the TMDL and for the Fenholloway Estuary model the critical low flow year of 2000 was used to evaluate the nutrient impacts. Also the BOD and ammonia instream decay rates were maintained at the levels measured during the mid 1990s calibration studies. With higher levels of treatment these decay rates may be lower, which would provide additional assimilative capacity. Using the 1990s measured decay rates provides additional margin of safety. If additional studies are completed and these instream decay rates are shown to be lower the modeling and TMDL can be reevaluated based on the new data and information.

5.4.5 Seasonal Variation

Seasonal variation was incorporated in the models by using the 1998 to 2000 critical period of record of flow recorded at the gages. Seasonality was also addressed by using all water quality data associated with the impaired streams, which was collected during multiple seasons.

6 Dioxin TMDLS

This section of the report details the development of a TMDL for dioxin in lower Fenholloway River (WBID 3477A)

6.1 Water Quality Assessment and Deviation from Target

6.1.1 Source Assessment

Dioxin does not occur naturally or if it does it is at levels that can not be detected in the environment, but can be a product from a dissolvedpulp mill.

6.1.2 Analytical Approach

The approach for calculating dioxin TMDLs is a mass balance of the numeric standard (0.014 ppq) and the ratio of the discharge flow to the harmonic mean river flow. However, since the Fenholloway River is an effluent dominated system and the human health protection should extend to both of the WBID stream sections below the Buckeye Florida discharge, a no dilution assumption was made. Therefore the TMDL equals the WLA which equals the human health criteria for Dioxin.

Table 12. Dioxin TMDL Components

WBID	Parameter	WLA (expressed as rolling annual average)	LA	TMDL
3473A	Dioxin	0.014 ppq	0	0.014 ppq

6.1.3 Margin of Safety (MOS)

The MOS for the dioxin TMDL is using the human health criteria with no dilution flow allowed.

6.1.4 Seasonal Variation

Establishing the WLA and TMDL at human health criteria limits provides year round protection**.**

7 Fecal and Total Coliforms for Bevins / Boggy Creek

This section of the report details the development of coliform TMDLs in Bevins(Boggy) Creek. Fecal and total coliforms are the parameters of concern. Fecal coliforms are a subset of the total coliform group and indicate the presence of fecal material from warm-blooded animals. Total coliform bacteria generally indicate the presence of soil-associated bacteria and result from natural influences on a water body such as rainfall runoff as well as sewage inflows.

Bevins (Boggy) Creek is located in Taylor County in the Steinhatchee Planning Unit. The Steinhatchee is part of the Suwannee River Basin. Bevins Creek is a tributary to the Steinhatchee River, which discharges into the Gulf of Mexico (see Figure 3). Land cover in the watershed is shown in Table 3 and is based on the National Land Cover Dataset (NLCD) obtained from 1990 Landsat Thematic Mapper Data (Vogelmann, 2001). Wetlands and forested areas are the dominant features of the Bevins Creek watershed. Although the NLCD data is from 1990 images, land cover in the Taylor County area has not changed significantly. According to the Florida Department of Environmental Protection (DEP) Basin Status Report for the Suwannee Basin, the Steinhatchee River watershed is 98 percent pine flatwoods and wetlands, most of which is used for commercial timber production (DEP, 2001).

7.1 Water Quality Assessment and Deviation from Target

FDEP maintains an ambient monitoring station on Bevins(Boggy) Creek at State Route 51 (see Figure 1) near the confluence of the Steinhatchee River. Coliform data was collected at this station in 1989 and in 2002 and is provided in Table 13. Flow is not measured at the time of sampling. A statistical summary of the data is provided in Table 14.

Table 13 Coliform Data Collected in Bevins (Boggy) Creek at SR51

Date	Fecal Coliform (counts/100ml)	Remark Code	Total Coliform (counts/100ml)	Remark Code
2/8/89	170		600	
4/5/89	400		43	
6/7/89	2000	L	1000	
8/16/89	20		2700	L
9/4/02	64		715	
9/11/02	46		1200	
9/24/02	72		1050	
10/16/02	1800		2700	
10/24/02	520		2900	
11/6/02	150		1500	
12/3/02	28		350	

Note: Remark code “L” refers the value is off-scale high; actual value is not known, but known to be greater than the value shown.

Table 14. Statistical Summary of Coliform Data in Bevins(Boggy) Creek

Parameter	Geometric Mean	# Samples Exceed 400 (fecal) or 2400(total)	Minimum (counts/100ml)	Maximum (counts/100ml)
Fecal Coliform	NA	3 of 11 or 27%	20	2000
Total Coliform	NA	3 of 11 or 27%	43	2900

Note: NA means not available as insufficient number of samples collected in a 30-day period to calculate the value.

The target for the fecal and total coliform TMDLs is the not to exceed 400 in 10 percent of the samples and not to exceed 2400 counts per day in 20 percent of the samples, respectively. By meeting water quality standards using the percent exceedence frequency for fecal coliform and the not to exceed criteria for total

coliform, standards should also be met during all other conditions.

7.2 Source Assessment

An important part of the TMDL analysis is the identification of source categories, source subcategories, or individual sources of coliform bacteria in the watershed and the amount of pollutant loading contributed by each of these sources. Sources are broadly classified as either point or non-point sources.

A point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Point source discharges of industrial wastewater and treated sanitary wastewater must be authorized by National Pollutant Discharge Elimination System (NPDES) permits. NPDES permitted facilities discharging treated sanitary wastewater or stormwater (i.e., Phase I or II MS4 discharges) are considered primary point sources of coliform.

Non-point sources of coliform are diffuse sources that cannot be identified as entering a waterbody through a discrete conveyance at a single location. These sources generally, but not always, involve accumulation of bacteria on land surfaces and wash off as a result of storm events. Typical non-point sources of coliform include:

Wildlife
Agricultural animals
Onsite Sewer Treatment and Disposal Systems (septic tanks)
Urban development (outside of Phase I or II MS4 discharges)

7.1.1 Point Sources

There are a no point sources located in the Bevins Creek drainage area that possess NPDES permits for discharges of treated sanitary wastewater.

Municipal Separate Storm Sewer Systems (MS4s) may also discharge bacteria to waterbodies in response to storm events. Currently, large and medium MS4s serving populations greater than 100,000 people are required to obtain a NPDES storm water permit. In March 2003, small MS4s serving urbanized areas will be required to obtain a permit under the Phase II storm water regulations. An urbanized area is defined as an entity with a residential population of at least 50,000 people and an overall population density of 1,000 people per square mile. There are no municipalities in the Bevins Creek watershed classified as an MS4 area. All future MS4s permitted in the area are automatically prescribed a WLA equivalent to the percent reduction assigned to the LA.

7.1.2 Non-point Sources

7.2.2.1 Wildlife

Wildlife deposit bacteria with their feces onto land surfaces where it can be transported during storm events to nearby streams. The bacteria load from wildlife is assumed background, as the contribution from this source is small relative to the load from urban and agricultural areas. In addition, any strategy employed to control this source would probably have a negligible impact on obtaining water quality standards.

7.2.2.2 Agricultural Animals

Agricultural activities including runoff from pastureland and cattle in streams have the potential to impact water quality. Based on land cover in the watershed and information provided in the Suwannee Basin Status Report, agricultural activities are not considered a significant source of coliform impairment.

7.2.2.3 Onsite Sewerage Treatment and Disposal Systems (Septic Tanks)

Onsite sewage treatment and disposal systems (OSTDs) including septic tanks are commonly used where

providing central sewer is not cost effective or practical. When properly sited, designed, constructed, maintained, and operated, OSTDs are a safe means of disposing of domestic waste. The effluent from a well-functioning OSTD is comparable to secondarily treated wastewater from a sewage treatment plant. When not functioning properly, OSTDs can be a source of nutrient (nitrogen and phosphorus), pathogens, and other pollutants to both ground water and surface water.

Septic tanks are the predominant method of domestic wastewater disposal in the Suwannee Basin. In the Bevins Creek watershed, urban area accounts for less than one percent of the total area. Because the population density is low, septic tanks are not a significant area of concern.

7.2.2.4 Urban Development

Fecal coliform loading from urban areas is attributable to multiple sources including storm water runoff, illicit discharges of sanitary waste, runoff from improper disposal of waste materials, leaking septic systems, and domestic animals. The Bevins Creek watershed contains little urban development.

7.2 Analytical Approach

The approach for calculating coliform TMDLs depends on the number of water quality samples and the availability of flow data. When long-term records of water quality and flow data are not available, as is the case for Bevins Creek, the TMDL is expressed as a percent reduction. The reduction is based on instream samples violating the water quality criteria and the target concentration.

7.2.1 Development of Total Maximum Daily Loads

The TMDL process quantifies the amount of a pollutant that can be assimilated in a waterbody, identifies the sources of the pollutant, and recommends regulatory or other actions to be taken to achieve compliance with applicable water quality standards based on the relationship between pollution sources and in-stream water quality conditions. A TMDL can be expressed as the sum of all point source loads (Waste Load Allocations), non-point source loads (Load Allocations), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$TMDL = \Sigma WLAs + \Sigma LAs + MOS$$

The objective of a TMDL is to allocate loads among all of the known pollutant sources throughout a watershed so that appropriate control measures can be implemented and water quality standards achieved. 40 CFR §130.2 (i) states that TMDLs can be expressed in terms of mass per time (e.g. pounds per day), toxicity, or other appropriate measure. TMDLs for the impaired waterbodies are expressed in terms of a percent reduction.

7.2.2 Critical Conditions

The critical condition for non-point source coliform loading is an extended dry period followed by a rainfall runoff event. During the dry weather period, coliforms build up on the land surface, and are washed off by rainfall. The critical condition for point source loading occurs during periods of low stream flow when dilution is minimized. Critical conditions are accounted for in the TMDL by using the maximum concentration measured in the stream. By meeting water quality standards with this data violation, standards should be met for all other coliform criteria.

7.2.3 Existing Conditions

Existing conditions are based on the instream water quality violations. When only a few samples exceed the target, the most recent measurement is used to represent existing conditions.

7.2.4 Margin of Safety

There are two methods for incorporating a MOS in the analysis: a) implicitly incorporate the MOS using conservative model assumptions to develop allocations; or b) explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations. In the Bevin Creek TMDLs an implicit MOS was used, as the target of the TMDLs is the not to exceed criteria. It is more conservative to use the not to exceed criteria as the target rather than the one-day maximum criteria. Because the target of the TMDLs is the more conservative of the acute criteria, it is not necessary to provide any addition MOS.

7.3 Determination of TMDL, WLAs, & LAs

The TMDL values represent the required reduction necessary to maintain water quality standards. The TMDLs are based on the not to exceed concentration of the parameter as specified in the Class III WQS and are expressed as percent reductions. The TMDL value is reduced by the WLA, if any, to obtain the LA component.

There are no NPDES permitted facilities discharging coliforms to Bevins Creek. Any future facility permitted to discharge fecal coliform bacteria in the watershed will be required to meet permit limits. Future facilities discharging at concentrations less than the water quality standard should not cause or contribute fecal coliform bacteria impairment in the watershed.

The reduction prescribed for the Load Allocation (LA) component is based on the following equation:

Reduction = (maximum concentration – target)/max. concentration * 100

For fecal coliform the LA component is calculated using the concentration of 1800 counts/100ml measured on October 16, 2002. The percent reduction is:

Reduction = (1800 – 400) / 1800 *100 = 78 %

For total coliform the LA component is calculated using the concentration of 2900 counts/100ml measured on October 24, 2002. The percent reduction is:

Reduction = (2900 – 1000) / 2900 *100 = 66 %

TMDL components are shown in Table 3.

Table 15. TMDL Components for Bevins (Boggy) Creek (expressed as percent reduction)

Parameter	WLA	LA	MOS	TMDL
Fecal Coliform	0	78 %	Implicit	78 %
Total Coliform	0	66 %	Implicit	66 %

7.3.1 Seasonal Variation

Seasonal variation was incorporated in the TMDL analysis by using all water quality data associated with the impaired streams, which was collected during multiple seasons.

8 References

EPA Region 4, Draft Fenholloway River and Estuary Modeling Applications, September, 2003.

Florida Department Environmental Management (DEP), 2001. *Basin Status Report: Suwannee,* November 2001.

National Agricultural Statistics Service (NASS), Agricultural Census for 1997, U.S. Department of Agricultural.

SJWMD, "*Interim Pollutant Load Reduction Goals for Seven Major Lakes in the Upper Econfina River Basin, May 2003.*

TetraTech and EPA, Fenholloway River and Estuary: Hydrodynamic and Water Quality Modeling Report, May 2003

USDA, 1997. *1997 Census of Agriculture, Volume 1, Geographic Area Series, Part 42*, U.S. Department of Agriculture, National Agricultural Statistics Service. AC97-A-42, March 1999.

USEPA, 1991. *Guidance for Water Quality –based Decisions: The TMDL Process.* U.S. Environmental Protection Agency, Office of Water, Washington, DC. EPA-440/4-91-001, April 1991.

Vogelmann, J.E., S.M. Howard, L. Yang, C.R. Larson, B.K. Wylie, N. Van Driel, 2001. Completion of the 1990s National Land Cover Data Set for the Conterminous United States from Landsat Thematic Mapper Data and Ancillary Data Sources, Photogrammetric Engineering and Remote Sensing, 67:650-652.